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Centrifuge model tests of rainfall-induced slope failures for the investigation of the initiation conditions

Vasileios Matziaris, Alec Marshall, and Hai-Sui Yu

Nottingham Centre for Geomechanics, University of Nottingham, Nottingham, United Kingdom
(vasileios.matziaris@nottingham.ac.uk)

Rainfall-induced landslides are very common natural disasters which cause damage to properties and infrastructure and may result in the loss of human lives. These phenomena often take place in unsaturated soil slopes and are triggered by the saturation of the soil profile, due to rain infiltration, which leads to a loss of shear strength. The aim of this study is to determine rainfall thresholds for the initiation of landslides under different initial conditions. Model tests of rainfall-induced landslides are conducted in the Nottingham Centre for Geomechanics 50g-T geotechnical centrifuge. Initially unsaturated plane-strain slope models made with fine silica sand are prepared at varying densities at 1g and accommodated within a climatic chamber which provides controlled environmental conditions. During the centrifuge flight at 60g, rainfall events of varying intensity and duration are applied to the slope models causing the initiation of slope failure. The impact of soil state properties and rainfall characteristics on the landslide initiation process are discussed. The variation of pore water pressures within the slope before, during and after simulated rainfall events is recorded using miniature pore pressure transducers buried in the soil model. Slope deformation is determined by using a high-speed camera and digital image analysis techniques.